CLAIMS

What is claimed is:

1. A gas-metal arc welding of ferrous alloys comprising:

feeding a consumable metal-core electrode into a gas-metal arc welding apparatus, the metal-core electrode having a sheath and a core characterized by a core composition;

using Ar to form a non-oxidizing shielding atmosphere around the consumable metal-core electrode; and

igniting an arc between a ferrous alloy work piece and the consumable metal-core electrode to weld a carbon steel, low alloy steel or ferritic stainless steel work piece in the non-oxidizing shielding gas atmosphere.

2. The method of Claim 1, wherein Ar comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

3. The welding process of Claim 1, wherein the core comprises up to 45% wt of a metal powder and the iron powder comprises up to 44% wt of the core composition.

4. A gas-metal arc welding of ferrous alloys comprising using a noble single element gas as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel, low alloy steel or ferritic stainless steel work piece wherein a percentage of oxygen in a weld metal does not exceed 0.06% wt.

5. The gas-metal arc welding of Claim 4, wherein the noble single element gas is Ar.

6. The method of Claim 5, wherein the noble single element gas comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

7. The gas-metal arc welding of Claim 4, wherein the noble single element gas is selected from the group consisting of He, Ne, Rd and Xe.

8. The gas-metal arc welding of Claim 5, wherein a core composition of the metal-core wire comprises oxygen.

9. A gas-metal arc welding of ferrous alloys comprising using a noble single element gas, as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel, low alloy steel or ferritic stainless steel work piece wherein a fume generation rate does not exceed 0.25 gms/min.

10. The gas-metal arc welding of Claim 9, wherein the noble single element gas is Ar.

11. The method of Claim 10, wherein the noble single element gas comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

12. The gas-metal arc welding of Claim 9, wherein the noble single element gas is selected from the group consisting of He, Ne, Rd and Xe.

13. A gas-metal arc welding of ferrous alloys comprising using a noble single element gas as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel, low alloy steel or ferritic stainless steel work piece wherein stability of the arc is characterized by a standard deviation within the range from about 0.2 V to about 0.3 V.

14. The method of Claim 13, wherein the noble single element gas is Ar.

15. The method of Claim 14, wherein the noble single element gas comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

16. A gas-metal arc welding of carbon steel comprising using a noble single element gas as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel work piece wherein a toughness of a weld metal at 0 F of at least about 50 ft-lb at 0° F and at least about 41 ft-lb at -20° F.

17. The method of Claim 16, wherein the noble single element gas is selected from the group consisting of Ar.

18. The method of Claim 17, wherein the noble single element gas comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

19. A method of producing a weld comprising using a noble single element shielding gas in a gas-metal arc welding process of welding a metal-core wire electrode on ferritic stainless steels.

20. The method of Claim 19, wherein the noble shielding gas is Ar.

21. The method of Claim 20, wherein the noble single element gas comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

22. A gas-metal arc welding of ferrous alloys comprising:

feeding a consumable metal-core electrode into a gas-metal arc welding apparatus, the metal-core electrode having a sheath and a core characterized by a core composition;

using a mixture of noble gases selected from the group consisting of Ar, He, Ne, Rd and Xe to form a non-oxidizing shielding atmosphere around the consumable metal-core electrode; and

igniting an arc between a work piece and the consumable metal-core electrode to weld the carbon steel, low alloy steel or ferritic stainless steel work piece in the non-oxidizing shielding gas atmosphere.

23. The method of Claim 15, wherein the mixture of noble gases comprises residual amount of CO_2 and/or O_2 in concentrations not exceeding 1%.

24. The method of Claim 15, wherein the mixture of noble gases further comprises N_2 and/or N_2O_5 in concentrations not exceeding 2%.

25. The welding process of Claim 15, wherein the core comprises up to 45% wt of a metal powder and the iron powder comprises up to 44% wt of the core composition.

26. A gas-metal arc welding of ferrous alloys comprising using a mixture of noble gases, selected from the group consisting of Ar, He, Ne, Rd and Xe, as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel, low alloy steel or ferritic stainless steel work piece wherein a percentage of oxygen in a weld metal does not exceed 0.06% wt.

27. The method of Claim 19, wherein the mixture of noble gases comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

28. The gas-metal arc welding of Claim 19, wherein a core composition of the metal-core wire comprises oxygen.

29. A gas-metal arc welding of ferrous alloys comprising using a mixture of noble gases, selected from the group consisting of Ar, He, Ne, Rd and Xe, as a

shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel, low alloy steel or work piece wherein a fume generation rate does not exceed 0.25 gms/min.

30. The method of Claim 22, wherein the mixture of noble gases comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

31. A gas-metal arc welding of ferrous alloys comprising using a mixture of noble gases, selected from the group consisting of Ar, He, Ne, Rd and Xe, as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel, low alloy steel or ferritic stainless steel work piece wherein stability of the arc is characterized by a standard deviation within the range from about 0.2 V to about 0.3 V.

32. The method of Claim 24, wherein the mixture of noble gases comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 1%.

33. A gas-metal arc welding of ferrous alloys comprising using a mixture of noble gases, selected from the group consisting of Ar, He, Ne, Rd and Xe, as a shielding gas and a metal-core wire as a consumable electrode to weld a carbon steel work piece wherein a toughness of a weld metal at 0 F of at least about 50 ft-lb at 0° F and at least about 41 ft-lb at -20° F.

34. The method of Claim 26, wherein the mixture of noble gases comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 2%.

35. A method of producing a weld comprising using a mixture of noble gases, selected from the group consisting of Ar, He, Ne, Rd and Xe, in a gas-metal arc welding process of welding a metal-core wire electrode on carbon steel.

36. The method of Claim 28, wherein the mixture of noble gases comprises a residual amount of N_2, N_2O_5, O_2 or CO_2 not exceeding 2%.